Before the
Federal Communications Commission
Washington, D.C. **20554**

In the Matter of	)	
	)	
Additional Spectrum for Unlicensed Devices Below 900 MHz and in the 3 GHz Band	)	ET Docket No. 02-380
	)	

NOTICE OF INQUIRY

Adopted: December **11,2002** Released: December **20,2002**

By tbe Commission: Chairman Powell, Commissioners Abernathy, and Copps issuing separate statements; Commissioner Martin approving in pan. dissenting in part, and issuing a statement; Commissioner Adelstein not participating.

Comment date: **[75** days from publication in Federal Register]
Reply comment date: **[105** days from publication in Federal Register]

I. INTRODUCTION

1. We are initiating this inquiry to obtain comments from the public on the possibility of permitting unlicensed devices to operate in additional frequency bands. Specifically, we seek comments on the feasibility of allowing unlicensed devices to operate in TV broadcast spectrum at locations and times when spectrum is not being used, and on the technical requirements that would be necessary to ensure that such devices do not cause interference to authorized services operating within the TV broadcast bands.[1] We also seek comment on the feasibility of permitting unlicensed devices to operate in other bands, such as the 3650-3700 MHz band at power levels significantly higher than the maximum permitted for unlicensed devices in other frequency bands, with only the minimal technical requirements necessary to avoid interference to licensed and incumbent services. We believe that these actions could have significant benefits to the economy, businesses and consumers by allowing the development of new and innovative types of unlicensed devices.

II. BACKGROUND

2. Unlicensed transmitters may be operated under the provisions of Pan **15** of the Commission's Rules.[2] Part 15 transmitters generally operate on frequencies shared with authorized services and at

[1] The term "TV broadcast bands" refers to the 402 MHz allocated lo the broadcast services at 54-72 MHz, 76-88 MHz, 174-216 MHz, 470-608 MHz and 614-806 MHz. The band 470-512 MHz is allocated to the land mobile and commercial mobile radio services in 13 cities. and the broadcast auxiliary service also operates on certain channels in the TV broadcast bands. As of September 30, 2002, there were 1,714 TV stations. 4.739 TV translators. 2.127 low power TV stations and 568 Class A TV stations. There are over 1.4 million fixed and mobile stations authorized in the 470-512 MHz band. of which 96% are in the private land mobile service (equally shared between public safety and industrial/business services) and the remainder are in the commercial mobile radio and broadcast auxiliary services.

[2] See 47 C.F.R. Part 15.

relatively low power. Operation of a Part 15 transmitter is subject to the conditions that the device not cause interference to authorized services, and that the device must accept any interference received.[3] The Commission made two significant changes to Part 15 in the 1980's that enabled the development of new types of unlicensed devices and led to increased use of these devices.

3. The first significant change, in 1985, was to permit spread spectrum transmitters to operate on an unlicensed basis in certain bands allocated for Industrial, Scientific and Medical (ISM) equipment.[4] Specifically, such transmitters are permitted to operate in the 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz bands.[5] Spread spectrum transmitters spread their energy over a wide bandwidth, which increases resistance to interference and can allow multiple transmitters to share the same spectrum. Such transmitters are permitted to operate with a power of up to one watt, which is considerably higher than the maximum power permitted for other Part 15 devices![6] This allows for significantly greater transmission range than other Pan 15 devices. In addition, the relatively wide bandwidth permitted for spread spectrum transmitters makes them useful for applications such as high speed data transmission. There are no limitations in the rules on the types of applications for which spread spectrum devices can be used, provided they comply with the technical requirements. The adoption of the spread spectrum tules was a major step in providing increased flexibility for unlicensed transmitters. Subsequent changes to these rules permit increased data speeds and higher gain antennas to allow greater transmission range, and apply to a broader range of spread spectrum transmitters.[7]

4. The second significant change to Part 15 was a major revision in 1989. Under this revision, unlicensed transmitters are permitted to operate on almost any frequency, provided they meet relatively tight emission limits.[8] They are not permitted to operate in certain designated "restricted bands,"[9] and are generally prohibited from operating in the TV broadcast bands, except for remote control devices and medical telemetry transmitters."[10] Specific types of unlicensed transmitters can operate in certain

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[3] See 47 C.F.R. § 15.5.

[4] ISM equipment uses RF energy to perform some son of work. such as heating or lighting, and not to perform communications. Examples of ISM equipment include microwave ovens, RF lighting devices, ultrasonic cleaners and industrial heating and welding equipment. The technical requirements for ISM equipment are found in Part 18 of the Commission's rules, 47 C.F.R. Pan 18.

[5] *See First Report and Order* in GEN Docket No. 81-413, 1 FCC 2nd 419 (1985), 58 RR 2nd 251 (1985).

[6] The maximum permitted output of most Pan 15 transmitters is actually expressed in terms of field strength at a specific distance, which is a function of both the transmitter output power and the transmit antenna gain. These field strength limits correspond to relatively low transmitter output powers. For example, a non-spread spectrum transmitter in the 902-928 MHz band has a field strength limit of *50* millivolts per meter at a distance of 3 meters. See 47 C.F.R. § 15.249. A power of only 152 microwatts into a dipole antenna is required to generate this field strength.

[7] See 47 C.F.R. § 15.247. See also *Second Repon and Order* in ET Docket No. 99-231, 17 FCC Rcd. 10755 (2002).

[8] *See* 47 C.F.R. § 15.207 and 209

[9] Specific frequency hands are designated as restricted bands in Pan 15 to protect certain sensitive radio services from interference. such as those that protect safety of life or those that use very low received levels. such as satellite downlinks or radio astronomy. Only spurious emissions are permitted in restricted bands. See 47 C.F.R. § 15.205.

[10] See47 C.F.R. §§ 15.209.15.231, 15.241 and 15.242. Effective October 16.2002, equipment authorizations will no longer he granted for medical telemetry transmitters that operate in the TV broadcast hands. See 47 C.F.R. § 15.37(i).

frequency bands. In addition to spread spectrum transmitters in the ISM bands, non-spread spectrum transmitters can operate in the ISM bands for any type of application at lower power levels than spread spectrum transmitters. The 1985 and 1989 revisions of Part 15 have provided substantially increased flexibility in the types of unlicensed devices that can be developed, and led to the large numbers of unlicensed devices currently available today.

5. The Commission's Spectrum Policy Task Force conducted a comprehensive review of spectrum policy which included a public notice seeking comment on, among other issues, whether additional spectrum should be made available for unlicensed use." In addition, the Task Force held a public workshop on unlicensed spectrum use.[12] In response to the public notice, a significant number of parties stated that additional spectrum should be made available for unlicensed use.[13] Further, these parties indicated a general perception that the creation of unlicensed bands has been very successful in allowing the introduction of new technology and that additional unlicensed bands would create more such opportunities.[14]

III. DISCUSSION

6. The Commission's rules for unlicensed transmitters have been a tremendous success. A wide variety of devices have been developed and introduced under these rules for consumer and business use. including cordless telephones. home security systems, electronic toys. anti-pilfering and inventory control system and computer local area networks. Moreover, the past few years have witnessed the development of industry standards. such as IEEE 802.11b (Wi-fi), Bluetooth, and Home RF that have greatly expanded the number and variety of devices that operate in the 2.4 GHz ISM band." This has provided for the introduction of wireless headsets and computer connections for cellular and PCS phones, wireless computer peripherals such as printers and keyboards, and a host of new wireless Internet appliances that will use all of the spread spectrum bands. Because of this. a large number of new devices have been developed and placed into operation in the ISM bands.

7. The success of our unlicensed device rules for the ISM bands shows that there could be significant benefits to the economy, businesses and the general public in making additional spectrum available for unlicensed transmitters. We believe that the rules permitting unlicensed operation in the ISM bands have been successful for three reasons. First, because these bands are used primarily for ISM equipment which may not be impacted by interference from unlicensed devices. a significantly higher power can be permitted in these bands than in other unlicensed bands, allowing for the greater

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[11] "Spectrum Policy Task Force Seeks Public Comment on Issues Related to Commission's Spectrum Policies." *Public Notice,* ET Docket No. 02-135 (rel. June 6, 2002).

[12] "Spectrum Policy Task Force Announces Panelists for the August 1st Public Workshop on Unlicensed Spectrum and Experimental Licenses and the August 2nd Public Workshop on Interference Proteclion", Public Notice. ET Docket No. 02-135 (rel. July 26, 2002).

[13] For example. see the following comments in ET Docket 02-135: Motorola comments at 14, Parr-15.0~ comments at 3, Personal Telecommunications Technologies, Inc. comments at 3, Microsoft comments at 4, Information Technology Industry Council comments at 7 and Consumer Electronics Association comments at 5.

[14] *Id*

[15] These operating standards provide manufacturers with guidance for developing spread spectrum devices for the 2.4 GHz band. The IEEE 802.11b standard applies to direct sequence devices. while the Bluetooth and Home RF standards apply to frequency hopping devices.

operational range of unlicensed devices. Second, the ISM bands have sufficient spectrum to permit wide bandwidth uses such as video and high speed data transmissions, and to permit multiple users to share the bands. The 900 MHz ISM band is 26 MHz wide, the 2.4 GHz ISM band is 83.5 MHz wide, and the 5.8 GHz ISM band is 125 MHz wide. Third, there are no restrictions placed on the applications of devices that operate in these bands, which permits the development of new and innovative types of unlicensed transmitters.

8. To ensure that any bands where expanded unlicensed operation is permitted are at least as useful as the ISM bands, we believe that we should use similar criteria in establishing requirements for new bands where unlicensed transmitters can operate. We believe that we should also consider permitting additional flexibility to help enable the development of new and innovative types of unlicensed devices, such as power levels greater than the one watt maximum currently permitted for Part 15 devices and/or high gain antennas to enable greater transmission range. We have identified two possible candidate bands for such expanded unlicensed operation: the television broadcast bands and the 3650-3700 MHz band.

A. TV Broadcast Bands

9. Analog TV stations currently operate on 6 MHz channels designated 2-69 (54-72 MHz, 76-88 MHz, 174-216 MHz and 470-806 MHz).[16] To prevent interference, the Commission's rules require distance separations between co-channel and first-adjacent-channel TV stations." In addition, distance separations are required between UHF TV stations up to 15 channels apart.[18] As a result of these rules. there are a number of vacant TV channels at any given location in the country because co-channel stations, adjacent channel stations, and some UHF stations cannot be located within certain distances of each other without causing interference, or because no licensee is using a given channel at a particular location.[19]

10. The Commission is requiring analog television stations authorized under Part 73 of the rules to convert to digital transmissions." To accomplish this, the Commission has developed a new table of allotments for digital television stations.[21] Because the new digital TV system is more spectrally efficient.

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[16] *See* 47 C.F.R. § 73.603(a).

[17] Minimum separation distances are specified between analog TV stations. See 47 C.F.R. § 73.610.

[18] To prevent undesirable signal interactions within analog TV receivers, minimum separation distances apply between analog UHF stations and other analog UHF stations 2, 3, 4, 5, 7, 8, 14 and 15 channels apart. See 47 C.F.R. § 73.698.

[19] Co-channel distance separation requirements range from 248.6 to 353.2 kilometers. depending on the channel and the area of the country where the stations are located. See 47 C.F.R. § 73.610. First-adjacent-channel stations and stations at certain UHF channel separations must be separated by minimum distances ranging from 31.4 to 119.9 kilometers to avoid interference. See 47 C.F.R. § 73.698.

[20] Advanced Television Systems and Their Impacr upon the Existing Television Broadcast Service, MM Docket 87-268, *Sixth Repon and* Order, 12 FCC Rcd 14588 (1997).

[21] See 47 C.F.R. § 73.622. In developing the initial table of allotments for digital TV stations. the required separations to prevent interference between digital stations and between analog and digital stations were determined using minimum D/U ratios. See 47 C.F.R. § 73.623(c). New digital allotments added after the initial digital TV table of allotments must meet minimum separation distances to both digital and analog TV stations. See 47 C.F.R. § 73.623(d). Except for co-channel distance spacing requirements. digital TV stations alternatively may be co-located or separated by much shorter distances to analog or other digital TV stations. Generally. if such (continued....)

fewer channels will be needed after the transition to accommodate all existing television stations. Digital television stations will operate only on channels **2-51** after the transition, and television channels **52-69** have been reallocated for other uses.[22] During the transition to digital transmissions, each television station that was authorized before 1997 is being permitted to broadcast on two channels; one digital and one analog. At the end of the transition, each station will cease analog broadcasts and broadcast on a single digital channel.

11. During and after the digital television transition, there will be a number of TV channels in a given geographic area not being used by full service analog or digital TV stations because such stations will not be able to operate without causing interference to co-channel or adjacent channel stations. For example, the rules for new digital TV allotments require minimum separations ranging from **196.3** to **273.6** kilometers for co-channel stations, and separations of 110 kilometers for adjacent channel stations that are not co-located or in close proximity.[23] These minimum separation distances between stations were determined based on the assumption that the stations will operate at maximum power. However, a transmitter operating on a vacant TV channel at a lower power level than a TV station would not need as great a separation distances from co-channel and adjacent channel TV stations to avoid causing interference to such stations. Thus, low power transmitters could potentially operate on vacant channels that could not be used by high power TV stations due to interference concerns. **Also,** in some areas channels that would otherwise be available for television service are not being used.

12. In addition to full service analog and digital TV stations under Part 73 of the rules, certain other TV broadcast services and unlicensed devices are permitted to operate on TV channels. Class **A** television stations operate under Subpart J of Part 73 of the rules. Low power TV stations, TV translator and TV booster stations under Part 74 of the rules are permitted to operate on a secondary basis to analog and digital TV stations, provided they meet technical rules to prevent interference to such stations.[24] Part 74 also permits TV broadcast stations to use TV channels **14-69** for specified TV broadcast auxiliary stations on a secondary basis.[25] In addition, Part 74 permits certain entities to operate wireless microphones on vacant TV channels on a non-interference basis.[26] In 13 metropolitan areas, one or two channels in the range of **14-20** are shared with the Private Land Mobile Radio Service (PLMRS) under Part 90 of the rules and the Commercial Mobile Radio Service (CMRS) under Part **20** of the **rules.** In addition, medical telemetry equipment is permitted to operate on an unlicensed basis on vacant TV channels 7-46. and remote control devices can operate on any TV channel above **70 MHz,** except for channel 37.[27]

(Continued from previous page)
stations are separated by about 20 kilometers or less, the predicted signal levels have a sufficiently high D/U ratio between signals to avoid interference.

[22] ***See First Report and Order*** in WT Docket No. 99-168, 15 FCC Rcd 476 (2000), ***Repon and Order*** in ET Docket 97-157, 12 FCC Rcd 22953 (1998) and ***Report and Order*** in GN Docket No. 01-74. 17 FCC Fcd 1022 **(2002).**

[23] These numbers are for separations between digital stations. ***See*** 47 C.F.R. § 73.623(d). The separations differ depending on the zone where the stations are located and whether the stations are in the VHF or UHF band.

[24] **See** 47 C.F.R. Part 74 Subpart G.

[25] ***See*** 47 C.F.R. § 74.602(h).

[26] **See47** C.F.R. § 74.861.

[27] ***See*** 47 C.F.R. §§ 15.231. 15.241 and 15.242. Effective October 16,2002. the Commission will cease granting certification for new medical telemetry equipment that operates on TV channels, but there is no cutoff on the sale or use of equipment that was certified before that date.

13. With the exception of medical telemetry and remote control devices, unlicensed devices are not permitted to operate in the TV bands under the current rules.[28] Such operation was prohibited in the 1989 Part 15 revision because of concerns that allowing more unlicensed devices in the TV bands could cause interference to the future digital TV stations.[29] Since the 1989 Pan 15 revision, there have been significant advances in technology that may make it feasible to design new types of unlicensed equipment that are able to share spectrum in the TV bands without causing interference to TV broadcast services or other licensed services operating within these bands. For example, advances in computer technology mean that it should be possible to design equipment that would monitor the spectrum to detect frequencies already in use and ensure that transmissions only occur on open frequencies. Also, the low cost of GPS equipment means that a device could have the capability of "knowing" where it is, and could use information obtained from a database to determine whether there are any licensed operations in its vicinity. Further, equipment can be designed that is frequency agile, with the capability of changing operating frequencies or bandwidth as needed to avoid interference to licensed users.[30] Thus, we believe it may now be possible to operate unlicensed transmitters under certain circumstances on TV channels without causing interference to any authorized services in the TV bands, provided the transmitter complies with appropriate limits on its power. operating frequency and location. These approaches would also protect new TV stations that begin operations on previously vacant channels.

14. The unused portions of the TV spectrum appear to be a suitable choice for expanded unlicensed operation for several reasons. There is significant bandwidth available because each TV channel is 6 MHz wide, and multiple vacant channels are generally available in an area to provide greater bandwidth. Allowing unlicensed devices to operate on TV channels that are not being used in a particular area would be a more efficient use of the spectrum. Unlicensed use of this spectrum as opposed to licensed use appears to be appropriate because the operating power levels of unlicensed devices are generally lower than the power levels used in commercial mobile radio services, making it easier for unlicensed devices to identify and operate on unused frequencies without causing interference to authorized services. Further, the frequencies and amount of unused TV spectrum vary from location to location and could change over time as TV stations or other authorized services are added or change frequency, potentially complicating the licensing of commercial services in unused TV spectrum. We note also that the unlicensed uses we identify in this NOI are not intended to limit future licensed use or to guarantee spectrum access rights for this band." We seek comment on the following questions concerning the use of the TV broadcast bands by unlicensed devices.

- Should new unlicensed devices be permitted to operate within any portions of the TV bands, and if so, which portions? Are there any other bands where new unlicensed devices could be permitted to operate?

- Should the use of certain channels by unlicensed device not be permitted? For example, channel 37 is allocated for radio astronomy operations and the Wireless Medical Telemetry Service, and unlicensed operations on this channel may not be appropriate because of special interference concerns associated with the sensitive nature of radio astronomy reception and the critical safety function of medical telemetry equipment. In addition, there are concerns about possible

[28] *Id.*

[29] See *Repon and* Order in GEN Docket No. 87-389, 4 FCC Rcd 3493,3501 (1989).

[30] We note that equipment with some of these capabilities is already in use both commercially and in the military. For example, wireless LANs operating in the 2.4 GHz and 5.8 GHz bands have the capability of sensing when a frequency is in use and changing to an available frequency.

[31] See. *e.g.*, 309(j)(14).

interference to channels 2, 3 and 4 because they are used for. or are adjacent to, the output channels of VCRs and other set-top boxes. Further. spectrum currently allocated to channels 52-69 (698-806 MHz) has been reallocated and has been or will be licensed for new services.[32] Should unlicensed operations be permitted in the reclaimed spectrum?

- Should there be geographic restrictions on where unlicensed operation in the TV bands is permitted, such as in areas where co-channel or adjacent channel television, Private Land Mobile Radio Service (PLMRS) or Commercial Mobile Radio Service (CMRS) is present, or in the border areas near Canada and Mexico?"

- What restrictions, if any, should be placed on the applications or numbers of unlicensed devices that would be permitted in the TV broadcast bands, and why would such restrictions be needed? For example, should applications be limited to fixed uses?

- Are any special, temporary restrictions needed to ensure that unlicensed devices do not impact the transition of television from analog to digital service? For example, as part of the transition process, television stations may be switching channels and modifying their service area. How can we ensure that unlicensed operation does not cause interference when stations make such changes or when new DTV stations commence operation?

- How would new unlicensed devices affect the ability of broadcasters to provide ancillary services such as data after the digital transition?

15. The Part 15 rules require unlicensed transmitters to meet technical requirements to ensure that they will not cause interference to authorized users. The types of requirements that must be met typically include in-band and out-of-band power or field strength limits, and may include other requirements such as bandwidth, power spectral density, frequency stability, and antenna gain. As noted above, there are several authorized users of the TV bands that must be protected from interference from unlicensed devices. Analog and digital TV stations must be protected from interference. Low power TV and TV translator stations have defined protected service contours.[34] Low power auxiliary stations such as wireless microphones and wireless assist video devices" on TV channels do not have defined protected contours, but unlicensed devices are not permitted to cause interference to them. PLMRS and CMRS base stations are assigned within 50 miles of the center of the cities where they are permitted to operate in the 470-512 MHz band, and mobile units must be operated within 30 miles of their associated base station or stations.[36] In addition to these authorized users, unlicensed medical telemetry transmitters are

[32] This band includes public safety services. for which some licenses have been assigned; spectrum controlled by guard band managers. which has been auctioned; and commercial mobile radio service bands, some of which have not yet been auctioned.

[33] PLMRS and CMRS operations are permitted on TV channels in the 14-20 range in certain markets. See 47 C.F.R. §§ 90.303 and 20.9.

[34] *See* 47 C.F.R. § 74.707

[35] The Commission recently authorized the use of wireless assist video devices on vacant TV channels on a non-interference basis. Such use is limited to channels 8-12. 14-36, and 38-51 and is subject to technical and notification rules to ensure that these devices do not cause interference to TV operations. ***See Revisions to Broadcast Auxiliary Service Rules in Part 74 and Conforming Technical Rules for Broadcast Auxiliary Service. Cable Television Relay Service and Fixed Services in Pans 74, 78 and 101 of the Commission's Rules,*** ET Docket No. 01-75. ***Report and Order,*** released November 13.2002.

[36] *See* 47 C.F.R. § 90.305.

permitted to operate on channels 7-46, although the Commission has allocated bands where such transmitters can operate with protection from interference." We seek comment on the following questions concerning the necessary technical requirements for unlicensed transmitters to prevent interference to TV reception and other authorized services within the TV bands,

- What power and/or field strength limits are necessary for unlicensed transmitters within the TV bands to prevent interference to TV reception? Could unlicensed devices operate in TV bands with a power greater than the 1 watt maximum permitted for Part 15 devices in the ISM bands or power greater than the general Part 15 limit?

- What separation distances or D/U ratios should be established between unlicensed devices and the service of analog, digital, Class A and low power TV and TV translator stations? What assumptions should be used lo determine these protection criteria? Should TV stations be protected only within their grade B or noise limited service contours. or should unlicensed devices be required to protect TV reception from interference regardless of the received TV signal strength?" Is protection necessary only for co-channel and adjacent channel stations? What special requirements, if any, are necessary to protect TV reception in areas where a station's signal is weak? Would minimum performance standards for receivers facilitate the sharing of TV spectrum with unlicensed devices?

- What technical requirements are necessary to protect other operations in the TV bands, including the PLMRS and CMRS in the areas where they operate on TV channels and low power auxiliary stations such as wireless microphones and wireless assist video devices? Could technical requirements be developed that would allow unlicensed devices to co-exist with new licensed services on former TV channels ***52-69?*** Should unlicensed transmitters be required to protect unlicensed medical telemetry transmitters operating on TV channels 7-46 from interference?

- What requirements, if any, are necessary to prevent interference to coaxial cable or other multi-channel video service providers using the TV bands or to prevent interference to TVs, VCRs and set-top boxes caused by direct pickup of signals from unlicensed devices?

- Should any antenna requirements be imposed? Can technologies such as "smart antennas". which automatically change their directivity as necessary, assist unlicensed devices in sharing the TV bands? Should unlicensed devices be required to use an integrated transmitting antenna and be prevented from using external amplifiers and antennas?

16. In addition to meeting power and/or field strength limits, we believe that an unlicensed device operating in the TV band should have certain capabilities to avoid causing interference to licensed services. Specifically, an unlicensed device should be able identify unused frequency bands before it can transmit. One possible approach would be for a device to monitor portions of the spectrum where it could operate. identify a frequency band that is not being used, and then transmit in the frequency band

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[17] These bands are 608-614 MHz, 1395-1400 MHz, and 1427-1429.5 MHz. See Repon ***and Order and Memorandum Opinion and Order*** in ET Docket No. 99-255 and 00-221, 17 FCC Rcd 368. While the Commission encouraged medical telemetry users to migrate out of the TV broadcast bands and into the bands where medical telemetry equipment can operate with protection from interference. it did not establish a cutoff date for equipment operating in the TV bands. ***See*** Repon ***and Order*** in ET Docket No. 99-255, 15 FCC Rcd 11,206 (2000).

[18] See 47 C.F.R. §§ 73.683(a), 73.633(e) and 73.6010(a) and (c). Low power TV stations, TV translator and TV booster stations may not cause interference to analog or digital TV stations regardless ***of*** the quality of the reception or the strength of the signal used. **See** 47 C.F.R. § 74.703(b).

identified. A device should also have to be able to avoid tying up a frequency in the event a licensed user wishes to commence transmissions. We seek comment on the following questions concerning the capabilities that unlicensed devices operating in the TV broadcast bands should have.

- What are the specific capabilities that an unlicensed transmitter should have to successfully share spectrum with licensed operations in the TV broadcast band without interference? Are there transmission protocols that could enable efficient sharing of spectrum?[39]

- Could GPS or other location techniques be incorporated into an unlicensed device so it could determine its precise location and identify licensed users in its vicinity by accessing a database? Would such an approach be reliable, and could it be combined with other methods to prevent interference to licensed services? What specific methods could be used to protect low power auxiliary stations such as wireless microphones that are not listed in a database?

- Once an unlicensed device commences transmissions on an open frequency, how can it ensure that interference will not be caused to a licensed user of that frequency who wishes to commence transmissions? Is there a mechanism that can avoid such "collisions" or mitigate their effect? For example, should these devices have limited "duty cycles" in a given frequency band?

- Is frequency agile equipment. as well as the protocols to enable efficient frequency sharing, feasible in the near-term?

- How could the Commission enforce any rules that may be adopted for unlicensed devices to ensure that such devices do not cause interference to authorized users of the TV bands?

- Is it necessary to establish any standards to allow sharing between unlicensed users of the TV bands? If so, how do we arrive at standards and what process should be put in place to make certain that the standards remain current and support innovation?

B. Unlicensed Operation in the 3650-3700 MHz Band

17. Another possible candidate band we have identified for expanded unlicensed operation is the 3650-3700 MHz band ("3650 MHz band"). The 3600-3700 MHz band was previously allocated for use by the Federal Government on a primary basis for radiolocation services, and for non-government use in the Fixed Satellite Service (FSS), limited to space-to-Earth transmissions in international inter-continental systems. Pursuant to the Omnibus Budget Reconciliation Act of 1993 ("OBRA-93"),[41] the National Telecommunications and Information Administration ("NTIA") identified the 3650-3700 MHz

[39] For example. a "listen-before-talk" approach could be used in which an unlicensed device monitors a portion of spectrum to ensure that there are no TV stations or other licensed services present before commencing transmissions. The military has developed "feature detectors" that are able to detect the presence of transmitted waveforms at very low signal levels, which could potentially be used to improve the performance of listen-before-talk systems.

[40] *See Amendment of the Commission's Rules with Regard to the 3650-3700 MHz Government Transfer Band,* ET Docket No. 98-237, Notice of Proposed Rule Making and Order, 14 FCC Rcd at 1295, 1297-98 (¶ 3) (1998) *("Notice and Order"). See also Amendment of Part 2 of the Commission's Rules Regarding Implementarion of the Final Acts of the World Administrative Radio Conference,* Geneva, 1979. General Docket 80-739, Second Report and Order, 49 FR 2357 (Jan. 19, 1984).

[41] *See Omnibus Budget Reconciliation Act of1993* ("OBRA-93"). Pub. L. No. 103-66, Title VI, § 6001(a)(3), 107 Stat. 312 (enacted August 10, 1993). See *also* H.R. Rep. No. 103-213, 103rd Cong., 1st Sess. (1993).

portion of this band for transfer, effective January 1999, from a Government/non-Government shared use status to a mixed-use status.[42] A condition of the transfer allows Government radiolocation stations to continue to operate indefinitely in the 3650 MHz band at three locations with a "radius of operation" of 80 kilometers (49.7 miles).[43]

18. In October 2000, the Commission allocated the 3650 MHz band for the fixed and mobile (base stations only) terrestrial services on a primary basis.[44] FSS operations in this band that were authorized. or for which an application had been filed, prior to December 1, 2000 were permanently grandfathered. New FSS operations in the band after that date are licensed only on a secondary basis to the newly allocated fixed and mobile services in the band. Simultaneously with this allocation decision, the Commission proposed, but has not yet adopted, rules for licensing the 3650 MHz band, including proposals on flexible use, geographic area licensing, and band managers.[45] A number of FSS stations operate in this band, and several satellite operators filed petitions for reconsideration, which are pending.[46] The satellite operators primarily seek relief from the growth restrictions placed on FSS users in this band. No licenses have been issued for new fixed and mobile services in the band. However, the Commission has issued authorizations for secondary FSS earth stations.

19. The 3650 MHz band allocation decision recognized that this 50 megahertz of spectrum could be used to fulfill a statutory mandate for assignment of licenses by competitive bidding. The Balanced Budget Act of 1997 mandated the auction of 15 megahertz at 1990-2110 MHz unless the President identified alternative spectrum. NTIA identified the 3650 MHz band as one possible substitute along with certain spectrum that the Commission recently allocated as part of ET Docket No. 00-221 ("27 MHz proceeding").[47] Thus, although the Commission found that allocation and subsequent auction of 3650 MHz to fixed terrestrial services would satisfy the statutory requirement, 15 MHz of spectrum made available as part of the 27 MHz proceeding, which also will be auctioned, could be used to satisfy this

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[42] *See Spectrum Reallocation Final Repon. Response to Title VI - Omnibus Budget Reconciliation Act* of 1993. NTIA Special Publication 95-312, released February 1995 *("Final Report").* Shared use means that a band of frequencies is generally available for both government and non-government use. *See* 47 C.F.R. § 2.105(b). Mixed use means that government use is limited by geographic area. by time or by other means so as to guarantee that the potential use by government stations is substantially less than the potential use to be made by non-government stations. *See* Section 113(b)(2)(B) of OBRA-93. See 47 U.S.C. § 923(b)(2)(B).

[43] The three locations are Pascagoula, Mississippi; Pensacola, Florida; and Saint Inigoes, Maryland. Any unlicensed operations in the 3650 MHz band would be required to protect Federal Government operations at these locations from interference.

[44] *See First Report and Order and Second Notice of Proposed Rule Making* in ET Docket No. 98-237, 15 FCC Rcd 20488.20489 (2000).

[45] Existing FSS operations are grandfatheredon a primary basis.

[46] Several parties tiled petitions for reconsideration of the allocation decision, arguing that satellite operations in the band after December 1, 2000 should not be secondary to the new allocation. These parties are EchoStar Satellite Corporation. Extended C-Band Ad Hoc Coalition. Lockheed Martin Corporation. and Inmarsat, Ltd.

[47] *See Repon and Order* in ET Docket No. 00-221, 17 FCC Rcd 368 (2002). The hands 1390-1395 MHz, 1427-1432 MHz and 1670-1675 MHz were identitied as possibilities for meeting the statutory requirement contained in the *Balanced Budget Act* of 1997, Section 3002(c), Pub. L. 105-33, 111 Stat. 251-258 (1997)("BBA"). Note that the statute stipulated that the criteria for substitution was based on a determination that the auction of other spectrum better services the public interest. convenience, and necessity and can reasonably be expected to produce comparable receipts at auction.

auction requirement."[48] We also note that permitting unlicensed operation in the 3650 MHz band would not preclude its auction for fixed services or preclude new FSS operations.

20. Unlicensed operation in the 3650 MHz band, which is part of the 3600-4400 MHz band used for Federal Government and satellite operations, has been prohibited.[49] However, the change in allocation status of the 3650 MHz band from Government/non-Government shared use to mixed use provides an opportunity for us to revisit this prohibition. The 3650 MHz band appears to be well suited for unlicensed operations for a number of reasons. First, it is a contiguous 50 MHz block of spectrum, so there is sufficient spectrum available to permit wide bandwidth applications such as high speed data transmissions. Also, it is not heavily used in most parts of the country because it is recently vacated government spectrum, and no licenses have been issued for new non-government services in the band. The only operations in this band that need to be protected from interference at this time are the FSS sites and three grandfathered government sites. and these are fixed operations at known geographic coordinates. making it easier avoid interference to them. Given that the proposed terrestrial uses of this band involve operations from fixed sites. it would appear that unlicensed operations could be compatible with future licensed uses. For these reasons, it may be possible to permit unlicensed devices to operate in this band with minimal restrictions except those necessary to avoid interference to licensed users in the band. For example, it may be possible to permit wideband operation with high gain antennas at power levels greater than the 1 watt maximum permitted for other unlicensed devices. If unlicensed devices are permitted to operate in this band, they may have to have capabilities such as frequency agility to avoid causing interference to any fixed service operations licensed in the band.

21. Allowing unlicensed operation with very minimal technical requirements could potentially permit the development of new and innovative types of unlicensed devices that could not be operated under the current rules. Higher power limits and high gain antennas would substantially increase the operational range of devices and could permit the development of new types of wireless data networks. We seek comment on the following questions concerning permitting unlicensed operation in the 3650 MHz band with minimal requirements.

- What are the potential benefits and drawbacks of permitting unlicensed operation in this band subject to only the minimum rules necessary to avoid interference to licensed users?

- Is it viable to license fixed operations in this spectrum as proposed and permit operation of Part 15 devices in unused portions on a non-interference basis?

- Could power levels greater than 1 watt be permitted for such operations without causing interference to authorized users within the band? If so, what is the maximum power level that could be permitted? Would any restrictions on antenna gain or directivity be necessary?

- What other requirements are necessary to protect FSS and Federal Government operations in the 3650 MHz band from interference? Are geographic restrictions on where an unlicensed device could operate necessary, and how could these be enforced? Could GPS be incorporated into a device so it could determine its precise location and distance from licensed users? Would such an approach be necessary or reliable?

- What other requirements would be necessary to prevent interference to other authorized services,

[48] *Id.*

[49] The band 3600-4400 MHz is designated as a restricted band under Part 15 of the rules, so only spurious emissions are permitted in that band. See 47 C.F.R. § 15.205(a).

such as out-of-band emission limits? What types of licensed services could share the 3650 MHz band with unlicensed devices?

- Is it necessary to establish any standards to allow sharing between unlicensed users of the 3650 MHz band? If so. how do we arrive at standards?

- Are there any other bands where unlicensed operation with minimal rules could be permitted without causing interference to authorized services? What other bands should we consider? What are the advantages of each?

IV. PROCEDURAL MATTERS

22. This is an exempt notice and comment rule making proceeding. *Ex parte* presentations are permitted, except during any Sunshine Agenda period. See *generally* 47 C.F.R. §§ 1.1200(a), 1.1203, and 1.1204(b)

23. Pursuant to Sections 1.415 and 1.419 of the Commission's rules, 47 C.F.R. §§ 1.415, 1.419. interested parties may file comments on before [75 days after publication in the Federal Register], and reply comments on or before [105 days after publication in the Federal Register]. Comments may be filed using the Commission's Electronic Comment Filing System (ECFS) or by filing paper copies. *See Electronic Filing of Documents in Rulemaking Proceedings*, 63 Fed. Reg. 24.121 (1 998).

24. Comments filed through the ECFS can be sent as an electronic file via the Internet at <http://www.fcc.gov/e-file/ecfs.html>. Generally, only one copy of an electronic submission must be filed. If multiple docket or rulemaking numbers appear in the caption of this proceeding, however, commenters must transmit one electronic copy of the comments to each docket or rulemaking number referenced in the caption. In completing the transmittal screen, commenters should include their full name, Postal Service mailing address, and the applicable docket or rulemaking number. Parties may also submit an electronic comment by Internet e-mail. To get filing instructions for e-mail comments, commenters should send an e-mail to ecfs@fcc.gov, and should include the following words in the body of the message, "get form <your e-mail address>." A sample form and directions will be sent in reply.

25. Parties who choose to file by paper must file an original and four copies of each filing. If more than one docket or rulemaking number appear in the caption of this proceeding, commenters must submit two additional copies for each additional docket or rulemaking number. All filings must be sent to the Commission's Secretary, Marlene H. Dortch, Office of the Secretary, Federal Communications Commission, The Portals, 445 Twelfth Street, S.W., Washington, D.C. 20554.

26. Parties who choose to file by paper should also submit their comments on diskette. These diskettes should be submitted to: Hugh L. Van Tuyl, Office of Engineering and Technology, Federal Communications Commission, The Portals, 445 Twelfth Street, S.W., Room 7-A 133, Washington, D.C. 20554. Such a submission should be on a 3.5 inch diskette formatted in an IBM compatible format using Word for Windows or compatible software. The diskette should be accompanied by a cover letter and should be submitted in "read only" mode. The diskette should be clearly labeled with the commenter's name, proceeding (including the lead docket number, in *this* case ET Docket No. 02-380, type of pleading (comment or reply comment), date of submission, and the name of the electronic file on the diskette. The label should also include the following phrase "Disk Copy - Not an Original." Each diskette should contain only one party's pleadings, preferably in a single electronic file. In addition, commenters must send diskette copies to the Commission's copy contractor, Qualex International, 445 12th Street, S.W., Room CY-B402, Washington, D.C. 20554.

27. Comments and reply comments will be available for public inspection during regular business hours in the Reference Information Center (Room CY-A257) of the Federal Communications Commission, The Portals, 445 Twelfth Street, S.W., Washington. D.C. 20554. Copies of comments and reply comments are available through the Commission's copy contractor, Qualex International.

28. Alternative formats (computer diskette, large print. audio cassette and Braille) are available to persons with disabilities by contacting the Consumer and Governmental Affairs Bureau at (202) 418-2514, TTY (202) 418-2555, or at fccinfo@fcc.gov. The ***Notice** of Inquiry* can also be downloaded at: www.fcc.gov/dtf/.

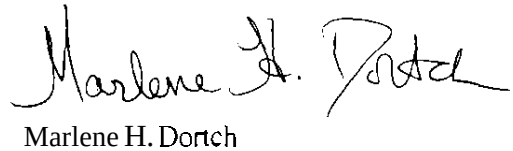
29. To make cited sources more easily available to the readers, we are testing the use of hyperlinks to some FCC documents that are cited in this document. The World Wide Web addresses/URLs that we give here were correct at the time this document was prepared but may change over time. We also advise that the only definitive text of FCC documents is the one that is published in the FCC Record. In case of discrepancy between the electronic documents cited here and the FCC Record, the version in the FCC Record is definitive.

V. **ORDERING** CLAUSES

30. IT IS ORDERED that, pursuant to Sections 4(i), 302, 303(e), 303(f), 303(r) and 307 of the Communications Act of 1934, as amended, 47 U.S.C. Sections 154(i), 302. 303(e), 303(f), 303(r) and 307, this Notice of Inquiry **IS** HEREBY ADOPTED.

31. For further information regarding this Notice of Inquiry, contact Mr. Hugh L. Van Tuyl, Office of Engineering and Technology, (202) 418-7506, e-mail hvantuyl@fcc.gov.

FEDERAL COMMUNICATIONS COMMISSION



Marlene H. Dortch
Secretary

SEPARATE STATEMENT OF CHAIRMAN MICHAEL K. POWELL

Re: ***Additional*** Spectrum ***for Unlicensed Devices below 900 MHz and in the 3 GHz Band***

Americans have always been pioneers. We have used technology to open up the West, to explore the seas, and to enter space. Just as the American entrepreneurial spirit compelled those new frontiers, so must the Commission explore new spectrum frontiers made possible by technological change. Today's item does just that. Technological advances now allow "smart" low power devices to communicate in spectral open spaces that were previously closed to development. These technological advances are great news for the American people. Our goal in today's item is to allow for the more efficient and comprehensive use of the spectrum resource while not interfering with existing services. The Commission's Spectrum Policy Task Force Report provided some guideposts to achieving that goal. Among the Task Force's key findings was the obvious success of our current unlicensed spectrum policy model. Indeed, unlicensed devices have become ubiquitous. with estimated sales of over $2 billion. With that lesson in hand, whether or not we put in place policies that build on that success is the question we begin to answer today.

SEPARATE STATEMENT OF
COMMISSIONER KATHLEEN Q. ABERNATHY

Re: Addirional Spectrum for Unlicensed Devices Below 900 MHz and in the 3 GHz Band. Notice of Inquiry

I believe the power of unlicensed spectrum services – and the corresponding rise in consumer welfare – is one of the great success stories of U.S. telecommunications policy. Unlicensed devices have rapidly become commonplace in the American home and office; they are relied upon for many everyday functions in consumers' lives. Unlicensed devices include cordless phones, computers, baby monitors. garage door openers, PDAs, and wireless local area networks. I recently have spoken about the need for the Commission and industry to think creatively and explore ways to create new unlicensed opportunities. This NOI represents an important step in that direction. We are striving to promote two important interests: ensuring that incumbents are protected from harmful interference and allowing innovative technologies to take advantage of unused spectrum. Since we are charged with effectively and efficiently harnessing the spectrum resource, the Commission must explore new ways to tap into that resource, consistent with our core responsibility to protect licensed users from harmful interference.

SEPARATE STATEMENT OF COMMISSIONER MICHAEL J. COPPS

RE: *Additional Spectrum for Unlicensed Devices Below 900 MHz and in the 3 GHz Band*

We arc all excited about the potential of unlicensed spectrum and the benefits it can briny to American consumers. There is no question that our Part 15 rules and unlicensed technologies are extremely important *to* the future. Hopefully they will contribute to more innovative management of the spectrum. So I most definitely support exploring ways to make more spectrum available for unlicensed devices

The Commission is struggling with how to address what looks like a spectrum crunch that gels more dire every day. Our Part 15 rules and unlicensed technologies are extremely important to the future of the Commission's management of the spectrum because they may provide us with spectrum resources that our current spectrum management paradigm doesn't recognize.

At the same time, we must find a way to balance the need to provide spectrum resources for innovators. entrepreneurs, and new technologies with the equally important need to avoid unacceptable levels of interference to incumbent users and consumers. The Part 15 rules and the use of unlicensed devices will play a central role in addressing this challenge. I hope that we will be able to determine the wisdom of the suggestions in this NOI, and then move quickly from ideas to action.

Thanks to OET for its role in getting us to today. I am pleased that the Commission is charting this new path.

SEPARATE STATEMENT OF
COMMISSIONER KEVIN J. MARTIN,
APPROVING IN PART AND DISSENTING IN PART

Re: ***Additional Spectrum for Unlicensed Devices Below 900 MHz and in the 3 GHz Band, Notice of Inquiry***

I strongly support making more spectrum available for unlicensed devices. Unlicensed devices have been a huge success story, from cordless phones to wireless broadband connections, such as 802.11b and Bluetooth. I am hopeful that unlicensed operations will, as some have suggested, eventually provide a last-mile application to connect people's homes to the Internet, offering a real alternative to telephone wires. cable, and satellite connections. I thus believe the Commission should consider a range of additional allocations for unlicensed devices.

I have reservations, however, with this item's inquiry into permitting additional unlicensed devices IO operate in the TV broadcast bands at this time. While I support making more spectrum available for unlicensed use, I am concerned that opening this inquiry into the TV broadcast bands at this time may create additional uncertainty and potentially delay the digital transition.

Under Chairman Powell's leadership, we have taken several steps in the last year to facilitate the digital transition. While still trying to build momentum to move broadcast stations from analog into digital, I am hesitant to inject the additional complications caused by significant unlicensed use in the broadcast bands at this time.

First, I fear that these unlicensed devices will create additional interference problems when digital television gets underway. Interference already threatens to impede the introduction of digital television. Although digital television stations have begun operating only in the last twelve months, we have received several reports of interference problems. For example, we are currently adjudicating a claim that a digital station in Norfolk, Virginia (WHKO-DT) is causing interference to an analog station in Salisbury. Maryland (WBOC-TV). This claim has been pending since June 11, 2002, and is an example of how interference can create significant problems that need to be resolved. At the same time, difficulties have surfaced for the existing unlicensed devices operating in the broadcast bands. Wireless microphone users, for example, are finding it increasingly difficult to find available spectrum.

In this environment, I am reluctant to open an inquiry into allowing more unlicensed devices in the broadcast bands. Such an inquiry risks causing significant uncertainty, as licensees must consider the potential for additional interference as well as a new class of users with expectations for spectrum in these already crowded bands. In my view, we ought to concentrate on providing more – not less – certainty, so that licensees can develop rational business plans and move forward expeditiously with the digital transition.

At the same lime, I am somewhat skeptical of the benefits of opening this inquiry. As part of the digital transition, we have dramatically increased the number of broadcast licenses in the broadcast bands. Particularly in urban areas, such as along the east and west coasts, there is much less broadcast spectrum available within which unlicensed devices could operate effectively.

There is much more broadcast spectrum available in rural areas. But I am concerned about the impact of unlicensed devices on TV viewers in rural areas. It is viewers in rural areas that are most likely to be without access to cable and to receive their TV from over-the-air broadcast signals. Moreover, many rural viewers receive their TV signals from great distances, beyond the so-called "grade B" contour, outside of which TV signals would typically not be guaranteed protection against interference. I fear that such unlicensed devices could interfere with the broadcast stations many rural viewers watch

and that rural viewers would lose the few broadcast signals upon which they rely. Such an outcome seems particularly unfair in light of last year's decision not to grant pending applications for new TV stations for many rural communities in the lower 700 MHz band. See Reallocation and Service Rules for the 698-746 MHz Spectrum Band (Television Channels 52-59), Report and Order, GN Docket No. 01-74, Separate Statement of Commissioner Kevin J. Martin (rel. Jan. 18, 2002). That decision denied numerous rural communities – such as Franklin. North Carolina, Blanco, Texas, and Fairmont, West Virginia – the opportunity to receive locally originated broadcast stations for the first time. Having refused to allow these communities new local stations – because we were concerned that there was not enough room left in the broadcast bands and because of the potential impact on the digital transition – it seems particularly inequitable to place distant rural signals at risk.

Finally, I question the timing of this item. This item is based around several recommendations of the Commission's Spectrum Policy Task Force Report. We only recently put that Report out for comment, with comments not even due until January 9,2003, and reply comments not due until February 10, 2003. It seems odd to me to initiate this proceeding before we even receive any comments on the Task Force's recommendations. If the Task Force Report was unnecessary for this item, the Commission could have released this item months ago, instead of delaying action for the Task Force to write its Report. If, on the other hand, the Task Force's work was instrumental to this item, it would make more sense to wait for comment on the Report before proceeding. Either way, after we have waited for the Task Force to finish its Report, it seems odd not to wait an additional month for the initial comments on the Report.

On balance, the speculative benefits of opening the broadcast band up, the risk to the digital transition, the potential harm to rural areas, and the pending proceeding on the Spectrum Task Force Report weigh against conducting this inquiry at this time. Accordingly, for all of the reasons above, I respectfully dissent in part.